Induction of wheat antioxidants.

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Producers of whole wheat products are interested in using high antioxidant (AOX) wheat in their products and marketing the recognized nutritional benefits but need assurance that they can access wheat with consistent, significant AOX levels. Research is now emerging that shows AOX to be the plant's defensive response to stress, particularly, insect or fungal attack. Recognition of insect feeding induces wheat plants to produce stress signals that activate peroxidases. Peroxidases, in turn, then mediate the production of phenolic compounds, which have been shown to act as chemical defenses, as well as lignin, which has been shown to act as a structural defense in wheat against feeding damage by the Hessian fly and several species of aphids. Previous work in our labs has enabled identification of wheat varieties with genetic potential to generate high AOX levels. The purpose of this research, sponsored by the Kansas Wheat Commission, is to determine the effect of specific stress factors that may be responsible for plant expression of higher AOX levels as a defensive response to the stress. Initial results will be shown.

SESSION III: ABIOTIC STRESSES

Improving drought stress tolerance in wheat: A grand challenge for the 21st century.

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Increasing global demand for food and predictions of a drier climate in many regions mean that crops will have to be more productive with less water. Although crop management offers some scope for increased productivity, enhanced crop genetics certainly will play a major role in dealing with more frequent and severe episodes of drought. But what are the best strategies for improving such a complex, multi-faceted trait as drought tolerance of wheat? One approach for improving yields under moisture stress is to select for yield potential or correlated traits under more favorable conditions, with the expectation that part of that yield benefit will be carried over to lower yielding, moderately stressed environments. For more severe stress, selection for specific drought adaptation traits may be beneficial, as long as those traits do not reduce yield under higher moisture conditions. Depending on the environment, selection for traits such as seedling root architecture, early vigor, leaf waxy layer, preflowering assimilate translocation, stem soluble carbohydrates, biomass through the Normalized Difference Vegetation Index (NDVI), or transpiration and plant water status through thermal imagery and near infrared spectroscopy may be of value. Useful sources of variability for drought adaptation include existing elite germplasm, landraces, and wild wheat (*Triticum turgidum* subsp. *dicoccoides* or *Aegilops tauschii*) in the form of synthetic hexaploids. Quantitative trait locus analysis and association analysis are gene discovery methods that will benefit from the development of a SNP marker platform, which is currently underway. Transgenes are another potential source of improved stress tolerance. Although the field performance of transgenic wheat designed for drought tolerance has not been encouraging, efforts in this arena are continuing and may bear fruit. We will present examples of drought tolerance research at Colorado State University and elsewhere and discuss some of the opportunities and challenges for achieving greater levels of drought tolerance for our region.